As a literary effort we cannot commend Mr. Holthouse's production: "interrogating the contents of tumours" (page 7) is as much too grand, as "the sudden flop with which" a hernia "slips in at the last" (page 51) is too familiar.
J. A., JR.

ART. XXVI.—*On the Law which Regulates the Relative Magnitude of the Areas of the Four Orifices of the Heart.* By HERBERT DAVIES, M. D., F. R. C. P., Senior Physician to, and Lecturer upon the Theory and Practice of Medicine at, the London Hospital, &c. 8vo. pp. 20. From the Proceedings of the Royal Society, No. 118, 1870.

DR. DAVIES has certainly developed some interesting facts, whether the reasoning upon which he bases the necessity of their existence be legitimate or not.

Using the measurements of Drs. Peacock and Reid, he shows that there is a striking approximation between the ratio of the area of the tricuspid to the area of the mitral orifice and that of the pulmonic to the aortic.

Thus, Dr. Peacock's measurements give—

$$\frac{\text{Area of Tricuspid}}{\text{Area of Mitral}} = 1.4\text{, nearly.}$$

$$\frac{\text{Area of Pulmonic}}{\text{Area of Aortic}} = \underline{1.3}\text{, nearly.}$$

$$\text{Showing a difference of but } .1$$

The approximation with Dr. Reid's measurements is still more marked. Thus—

$$\begin{array}{lcc} & \text{Males.} & \text{Females.} \\ \dfrac{\text{Area of Tricuspid}}{\text{Area of Mitral}} = & 1.31 & 1.36 \\ \dfrac{\text{Area of Pulmonic}}{\text{Area of Aortic}} = & \underline{1.26} & \underline{1.40} \\ & 0.05 & 0.04 \end{array}$$

Dr. Davies has also personally made a number of measurements in lower animals, and shows in the horse a difference of but .002; in the donkey, .04; ox, .01; calf, .04; sheep, .06 and .064; pig, .003 and .02; dog, .04 and .09.

This is indeed striking, and although we can hardly agree with Dr. Davies that the ratios are mathematically exact, or so nearly so that any differences must be due to necessary differences in measurements, we deem them sufficiently so to permit the laying down of a *physiological* law with regard to them.

With a view of confirming these results, Dr. Davies measured the pulmonic, mitral, and aortic orifices of a perfectly healthy heart, and from these data and the equations resulting from the above law, calculated the area of the tricuspid. Thus—

$$\frac{\text{Area of tricuspid}}{\text{Area of mitral}} = \frac{\text{Area of pulmonic.}}{\text{Area of aortic.}}$$

Or, by substituting known data—

$$\text{Area tricuspid} = 1.405 \times \frac{1.003}{.765} = 1.972.$$

He then measured the area of the tricuspid, and there resulted a difference between the measured and calculated results of but .098 inch.

So with the other orifices. And it is plain, also, how in this manner may be computed the difference between the measurement of a diseased orifice and its proper area, since the latter can be calculated from the equation. Such an instance is also given.

Again, on the supposition of the generally admitted data that—1st, the two ventricles are in health perfectly synchronous in their diastole and systole; 2d, that equal volumes of blood enter the ventricles during their diastole and are expelled during the systole; and 3d, that the ventricles are of equal capacity: since the amount of resistance to be overcome by the left ventricle is greater than that to be overcome by the right, it follows that "the perfect synchronism of the ventricular contractions can only be obtained by an exact graduation of the areas of the orifices of the aortic and pulmonary artery to the muscular forces impressed upon the contents of the two ventricles in systole, and consequently to the velocities of the streams issuing from those chambers. The area of the aortic must be therefore smaller than the area of the pulmonic, and in such proportion that the normal average contents (say three ounces) of the left ventricle shall occupy exactly the same time in passing through the aortic as is required by the three ounces of the right ventricle in passing through the pulmonic opening." The velocities of the streams must therefore be inversely as the areas of the orifices, and we have the following equations:—

$$\frac{\text{Velocity through aortic opening}}{\text{Velocity through pulmonic opening}} = \frac{\text{Area of pulmonic opening.}}{\text{Area of aortic opening.}}$$

Or, by substitution, velocity through aortic opening $= \frac{1 \text{ sq. inch}}{.75 \text{ sq. in.}} \times$ velocity through pulmonic opening $= 1\frac{1}{3}$ times the velocity through pulmonic opening; or, in other words, the velocities of the currents through the aortic and pulmonary orifices are in the ratio of 4 to 3.

By similar reasoning, the velocity through the tricuspid is shown to be $\frac{5}{7}$ velocity through mitral, or the velocities of the currents of blood in diastole through the tricuspid and mitral orifices are in the ratio of 5 to 7.

If, now, we concede that the ventricular contraction occupies $\frac{1}{3}$ the time between two pulses, it will occupy $\frac{1}{3}$ of $\frac{1'}{70}$, or $\frac{1'}{210}$; we have here data whence we calculate from the above equations the velocity of the blood through the

Aortic	orifice	to be	23.1	in.	per	second,	or	2310	yds.	or	1.3	miles	per	hour.
Pulmonic	“	“	17.3	“	“	“	“	1725	“	“	1	mile	“	“
Tricuspid	“	“	5	“	“	“	“	500	“	“	.28	“	“	“
Mitral	“	“	7	“	“	“	“	700	“	“	.4	“	“	“

In confirmation of the results that the velocities of the synchronous tricuspid and mitral currents are unequal, and that the latter presents a stronger dilating power than the former, Dr. Davies presents also the following reasoning:—

The two ventricles being of unequal thickness, and containing consequently unequal quantities and weights of muscular fibre, will necessarily require currents of blood of unequal momenta to overcome their respective *inertia*, fill their chambers, and complete their dilatation in exactly equal and the same times. That is, the momentum or the volume multiplied by the velocity of the mitral is greater than the momentum or volume multiplied by the velocity of the tricuspid current; but the volume in each is the same; hence, eliminating volume from each, we have the proposition to be demonstrated, that the velocity through the mitral is greater.

This novel method and these interesting results of Dr. Davies are decided contributions to our knowledge of the subject, and quite worthy the careful consideration of physiologists and pathologists, to whom we cordially recommend them. It would be a comparatively easy matter for those connected with large hospitals to repeat and extend these experiments, with a view to their confirmation or refutation.

After a careful perusal of Dr. Davies' essay, we cannot agree with a late reviewer in the *Journal of Anatomy and Physiology* that Dr. D. maintains—1. That the energy due to the contraction of the heart, by which resistance to the circulation is to be overcome, resides at the arterial orifices, in the form of *vis viva*. 2. That the velocity, and consequently the vis viva, of the blood depends upon the contractile force of the heart and the area of the arterial openings only. We believe this is more than he claims. His observations relate merely to the *relation between the size of the orifices*, and to the *average velocity* of the blood through those orifices, and he deals with the *vis viva* only in attempting, as it were, to confirm this latter. By *vis viva* is meant, as explained by Dr. Davies, the mass of blood in motion multiplied by the *square* of its velocity, differing in this latter respect from momentum, which is the mass of blood multiplied by the velocity. Momentum is substituted by Dr. D. for vis viva, since it does not affect the reasoning. It is true that, in referring to the forces which resist and at the same time aid the propulsion of the blood through the vessels, he omits, as by oversight, the force of the elastic coat of the vessels, but that does not affect the *fact* of the relations of the orifices, nor of the *average* rate through and at these orifices. J. T.

ART. XXVII.—*On the Causes, Prevention, and Treatment of Infantile Diseases; showing by what Means the present Mortality may be greatly reduced.* By SELBY NORTON, M. D., Fell. Obstet. Soc., Lond. 12mo. pp. 75. London: John Churchill & Sons, 1870.

A BOOK which would show us the means by which the present disproportionately large infant mortality could be reduced, would, we are sure, be warmly welcomed by the profession, and it is, therefore, with some feeling of disappointment that we express the opinion that the *means* which Dr. Norton points out are neither so novel nor so likely to be efficacious as he seems to think. The substitution of cow's milk properly diluted, for the various kinds of "improved food for infants" is expected to accomplish this most desirable result. We are, of course, perfectly well aware of the fearful amount of ignorance which prevails among mothers of all classes who are unable to nurse their infants, as to the proper kind of food to be given to them, but we cannot agree with the author in thinking that a similar want of knowledge is prevalent among physicians. The authors of most, if not all the standard works on diseases of children, call attention to the fact that farinaceous preparations, in consequence of the absence of teeth and the imperfect development of the salivary glands, can never be perfectly assimilated by infants during the first months of their existence, but must always be a cause of irritation to the stomach and bowels. Dr. Norton, however, brings forward this fact as one, if not entirely new, at least not generally known, and seems to attach so much importance to it, that we are forced to the conclusion that he is not quite as familiar with medical literature, even that of his own country, as he should be. Convinced, as we are, of the correctness of his views of the superiority of milk as an article of diet over the different preparations of starch, we cannot indorse his assertion that proper care being observed there will be no greater mortality among children so fed than among those brought up at the breast. The statement is, we think, scarcely true of England; it certainly is not of this country. Even with the greatest care that can be exercised an acid reaction will frequently, during summer, manifest itself as the consequence of the exposure of milk for a short time to the heat. This it is which renders children fed upon it, even in the country, liable to indigestions. How much greater this source of irritation must be in our large cities, and how impossible it will be to overcome it entirely will, we think, be evident to all.

Disorders of the digestive apparatus are not the only results of the administration of improper food, by which Dr. Norton means and understands starch; but it may by reflex action excite irritation of distant organs, as the lungs, larynx, and brain, manifesting its perturbating influence in the production of bronchitis, pneumonia, laryngismus stridulus, or convulsions. Bronchitis, he is disposed to think, very frequently originates from an error of diet in the infant, as it may also in the very old, and he regards its action as beneficial, for he says it gives rise to an increased secretion of mucus, "which after being coughed up in the throat is passed down into the stomach; the mucus completely coats every particle of the undigested something and floats it safely through the pylorus and through the whole length of the bowels." There may or may not be such a power as the vis medicatrix naturæ present in disease, but we submit that its action can scarcely be regarded as beneficial, when, as in this instance,